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ATTEMPT TO DETERMINE THE AGES OF APATITES, ZIRCONS AND GARNETS FROM THE ATHABASKA BASIN BY THE FISSION TRACK METHOD

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ATTEMPT TO DETERMINE THE AGES OF APATITES, ZIRCONS AND GARNETS FROM THE ATHABASKA BASIN BY THE FISSION TRACK METHOD

by

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ABSTRACT

Specimens submitted for age determination were unsuitable for fission track dating because they contained little or none of the datable mineral or because this mineral was weathered, fine-grained or cryptocrystalline. No dates were measured.

Keywords: Fission Tracks, Dating, Athabaska Basin, Apatite, Zircon, Garnet.

INTRODUCTION

The specimens submitted by Saskatchewan Research Council (S.R.C.) for fission track dating were not suitable for such measurements, and no dates were obtained. Some of the zircon specimens might have been datable if more material had been available, but the samples were small and consisted chiefly (in some cases almost entirely) of other minerals. The apatite specimens appeared most promising as apatites from such rock formations have frequently been dated by the fission track method. However, no apatite could be separated from many of the specimens said to contain it, and in the others the apatite was in the form of cryptocrystalline collophane in which fission tracks cannot be etched to recognizable forms. Some work has still to be done on the garnet-containing specimens, and it is hoped that one or more age determinations may be made on these. However, garnet is not usually datable by the fission track method, and the samples available contain little of this mineral.

ZIRCON

Only small amounts of the zircon specimens were available. Sieving showed that these consisted chiefly of light brown powders of mesh < 200. This was probably not zircon, and, in any case, it was too fine-grained to be useable in fission track dating. The larger grained (and usually darker coloured) fractions appeared weathered and friable and also appeared to consist chiefly of minerals other than zircon. Examination with a scanning electron microscope and electron microprobe confirmed the latter; the coarsest fraction of specimen no. Z13 may be ~ ½ zircon, while the other specimens contain much less of this mineral. In some, no crystals of zircon were found.

Some grains of a zircon are always lost during normal mounting and polishing procedures. Also, most of the grains which are mounted, polished and etched prove to be unuseable because of their orientations, uranium contents (which may be either too high or too low), zoning, fractures and inclusions or other factors. Therefore, a sample of at least several hundred grains is normally mounted, polished and etched and then searched

with the microscope for suitable grains. Probably a sufficient number of suitably large grains could not be obtained from any of these samples and in addition the zircon grains appear pitted, corroded, and weathered.

Zircon Specimens

MSL NO.	SRC NO.
Z13	CLU 2302/30.9
Z14	79VS 21/9
Z15	79VS 38/9
Z16	79VS 39/9
Z17	79VS 109/9
Z18	79VS 283/9
Z19	AG1P

APATITE

The apatite specimens were received as whole rocks from which this mineral had to be separated. The procedure with these was as follows: the rocks were crushed and sieved to obtain a fraction (usually of mesh 120-170) in which the mineral grains seemed to be separated and this was stirred in methylene iodide (density 2.96 g/mL). Apatite, with a density of 3.1-3.34 g/cm^3, should sink in this. Any grains which sank were separated, washed with acetone, and treated as apatite.

Portions of the heavy fractions were annealed at 510 ± 10°C for 2 hours and irradiated in the nuclear reactor at McMaster University with (2) 10^{15} neutrons/cm^2. Irradiated and unirradiated portions of each specimen were then mounted in epoxy disks, polished, and etched with 7% HNO_3 for 30 seconds.

Mineralogical studies at S.R.C. had indicated that these specimens were sandstones and mudstones in which apatite had formed, probably during diagenesis. The heavy separates were light grayish or brownish-pink and appeared to be chiefly apatite or collophane as would be expected from the mineralogy of the specimens. However, many of these specimens yielded very little or no heavy separate. Those which yielded enough for further work were: A23, A25, A27, A30, A32, A36, A37.

When examined through a microscope at 400x - 1000x the mounted and polished apatite usually proved to be fine-grained and opaque. Etching only

increased the roughness and opacity. In some of the specimens small transparent areas were found but these usually showed only the irregular and variable features resulting from grain boundaries and inclusions and their etching. In a few cases, short rod-like features having some resemblence to fission tracks were seen in these transparent areas but they were found to be distributed within the interiors of the grains as well as on the surface. They were, presumably, inclusions.

The heavy phosphate mineral therefore, appears to be the cryptocrystalline or amorphous form of apatite, collophane. Fission tracks presumably form in this material but cannot be revealed by etching because its grains or crystals are about the same size as the tracks or smaller. An etched surface is covered with features produced by the etching of grain boundaries which obscure the tracks and make the specimen opaque if it is not already so, and the tracks etch to irregular, unrecognizable forms.

Apatite Specimens

MSL NO.	SRC. NO.
A24	17505
A25	17506
A26	17509
A27	17511
A28	17520
A29	17537
A30	17539
A31A	17542A
B	B
A32	17561
A33	17564
A34	17567
A35	80-526-26-1-34-8*
A36	79-526-46-W25
A37	79-526-46-W27
A38	46-B-11
A39	P-101

* On specimens assumed to be this the number is 80-526-26-1-38.8.